

[54] **INTEGRATED HELMET AND MASK STRUCTURE**

[75] Inventors: **William K. Ansite**, Glendale; **John J. Mitchell, Jr.**, Arcadia, both of Calif.

[73] Assignee: **Sierra Engineering Co.**, Sierra Madre, Calif.

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Related U.S. Application Data

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[52] U.S. Cl. **128/142; 128/142.7**

[51] Int. Cl.² **A62B 7/00**

[58] Field of Search 128/141, 142, 146.7, 142.3, 128/142.7, 142.2, 142.5; 2/6

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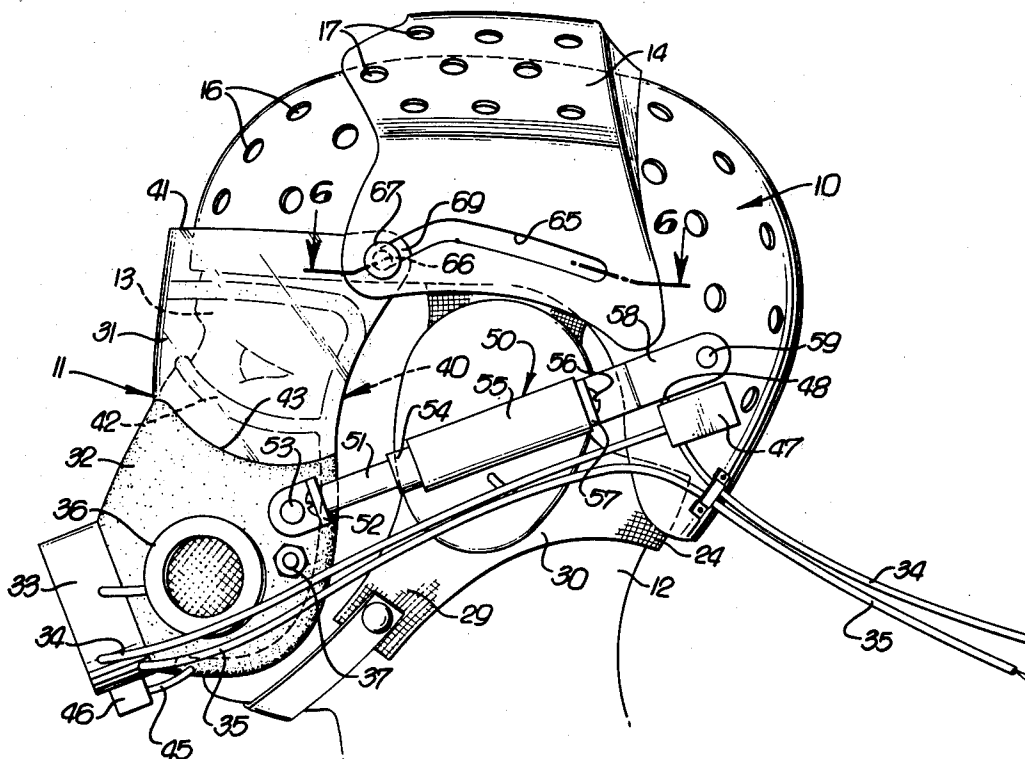
Primary Examiner—Richard A. Gaudet

Assistant Examiner—Lee S. Cohen

[57] **ABSTRACT**

For flying personnel there is provided a hard shell helmet suitably padded and held out of close contact with the head. An integrated visor assembly has an articulated attachment to the helmet movable between an operative position over the wearer's face and a lifted position extending over the top of the helmet removed from the face. Compound leverage elements making up the attachment determine a path of movement for the visor assembly such that it travels an irregular path allowing it to first lift clear of contact with the face and then travel upwardly to its lifted position. An inflatable seal extends around the perimeter of the visor assembly, the seal being inflated with air from the oxygen supply for the breathing mask when in operation over the face of the wearer and being collapsed when deflated providing additional clearance for ease of removal from the face and for storage in its lifted position.

7 Claims, 13 Drawing Figures



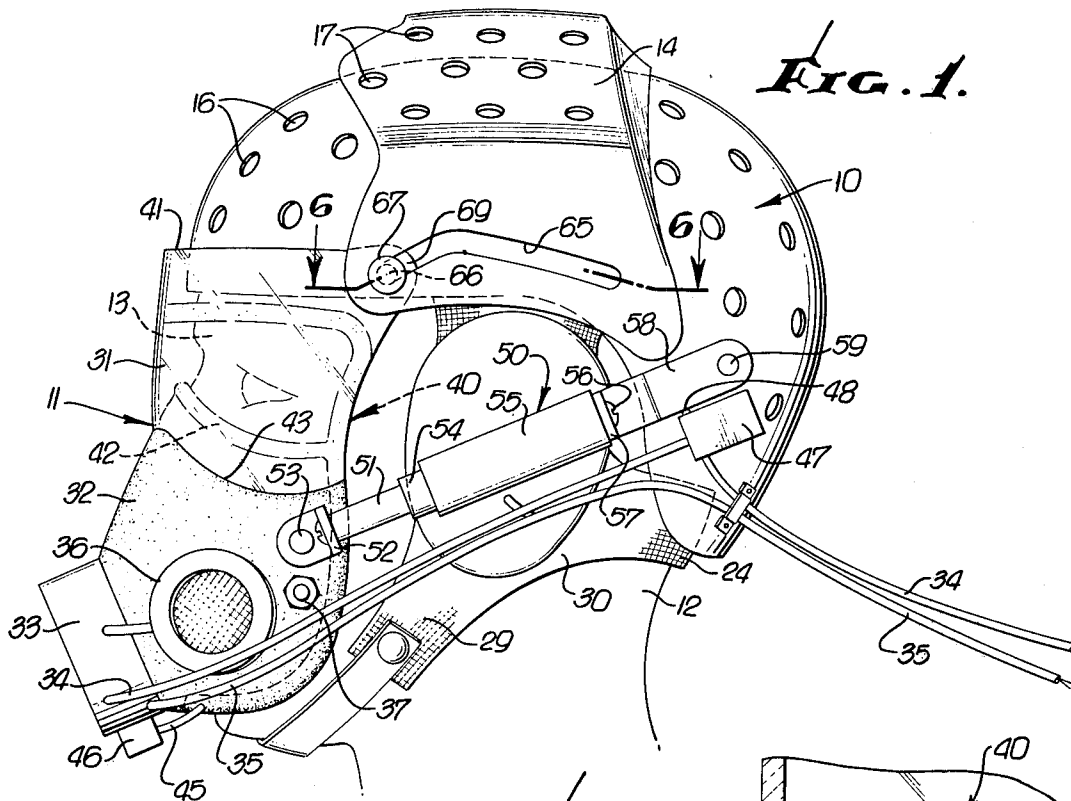


FIG. 1.

FIG. 2.

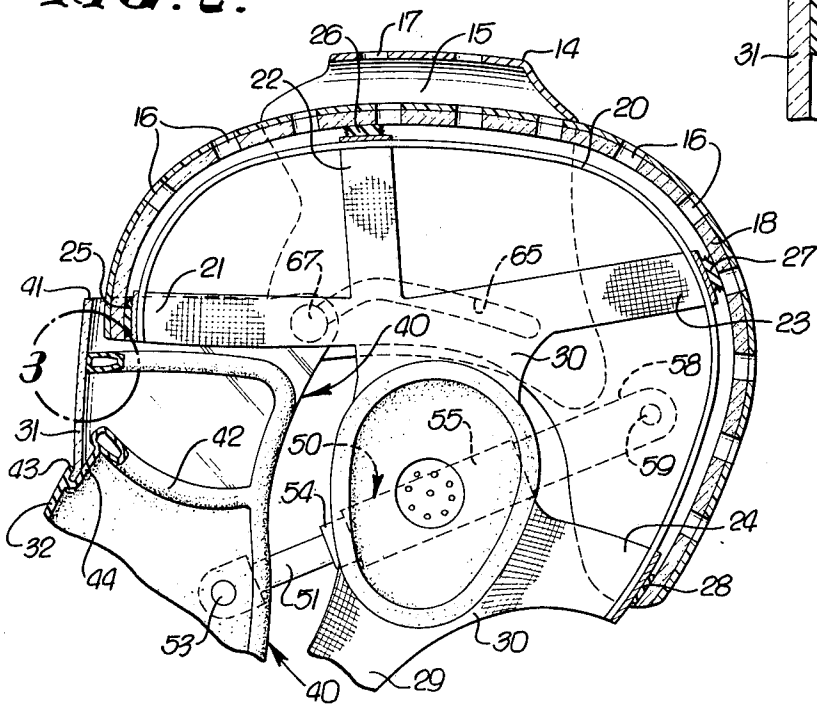


FIG. 3.

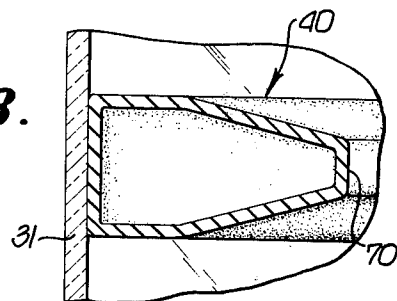


FIG. 4.

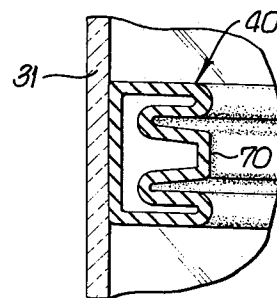


FIG. 5.

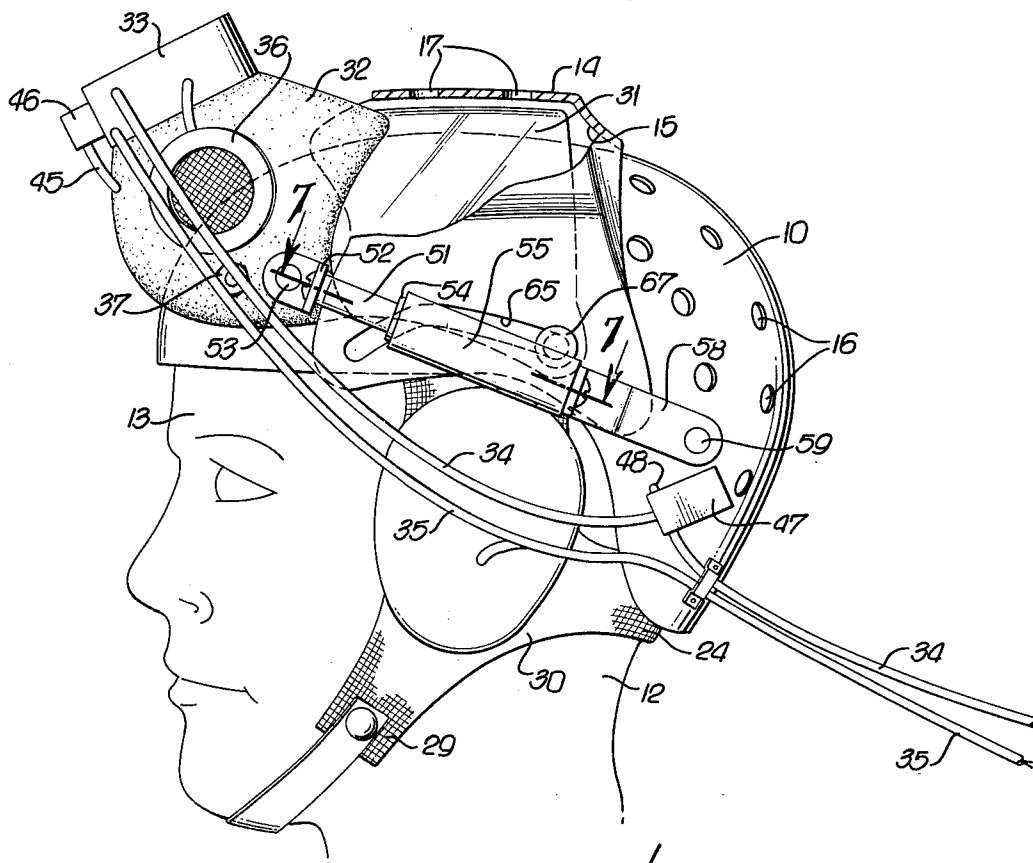


FIG. 6.

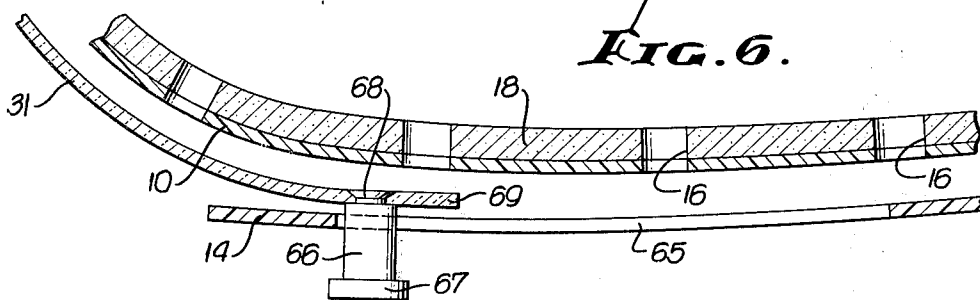


FIG. 7.

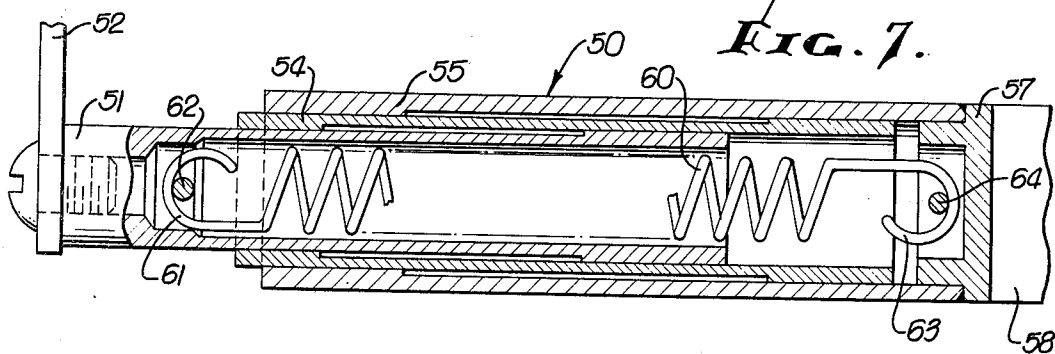


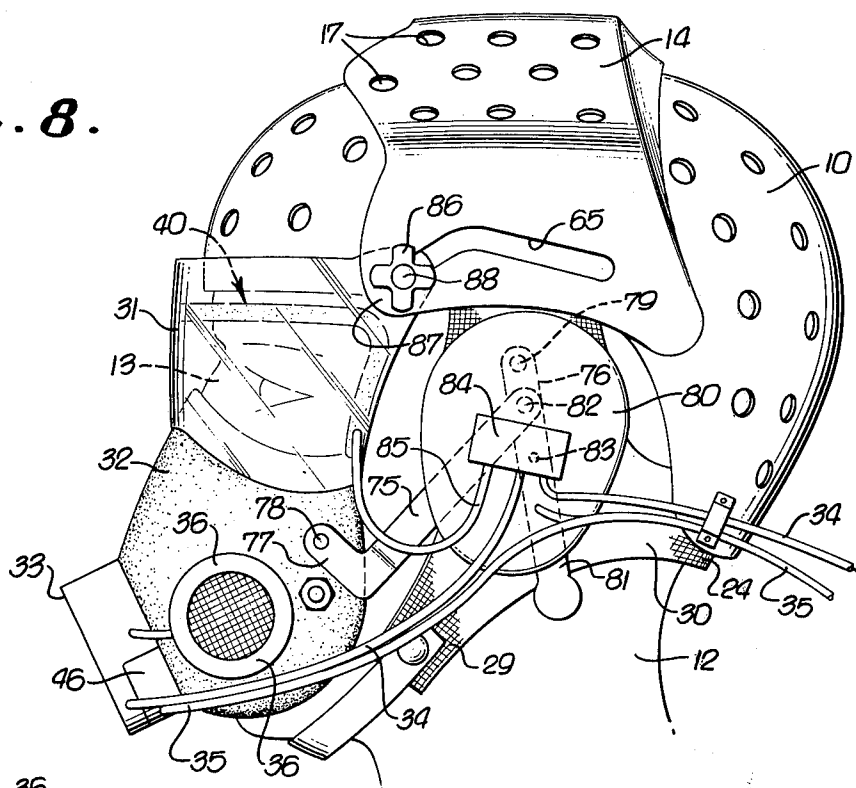
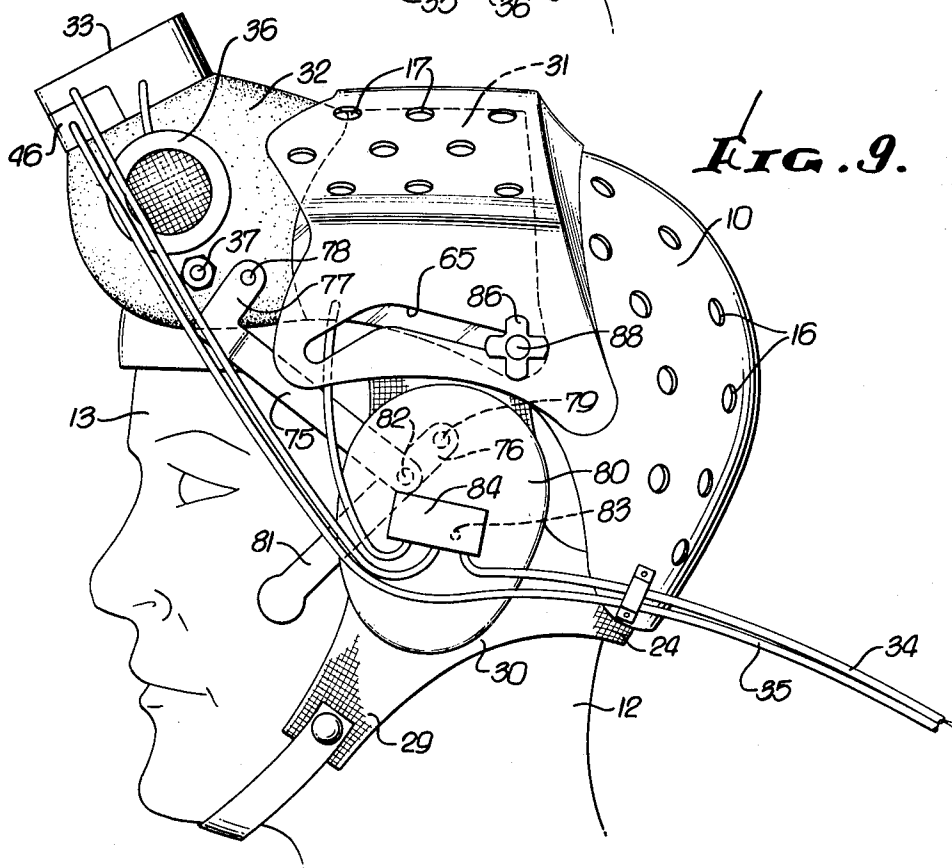
FIG. 8.**FIG. 9.**

FIG. 11.

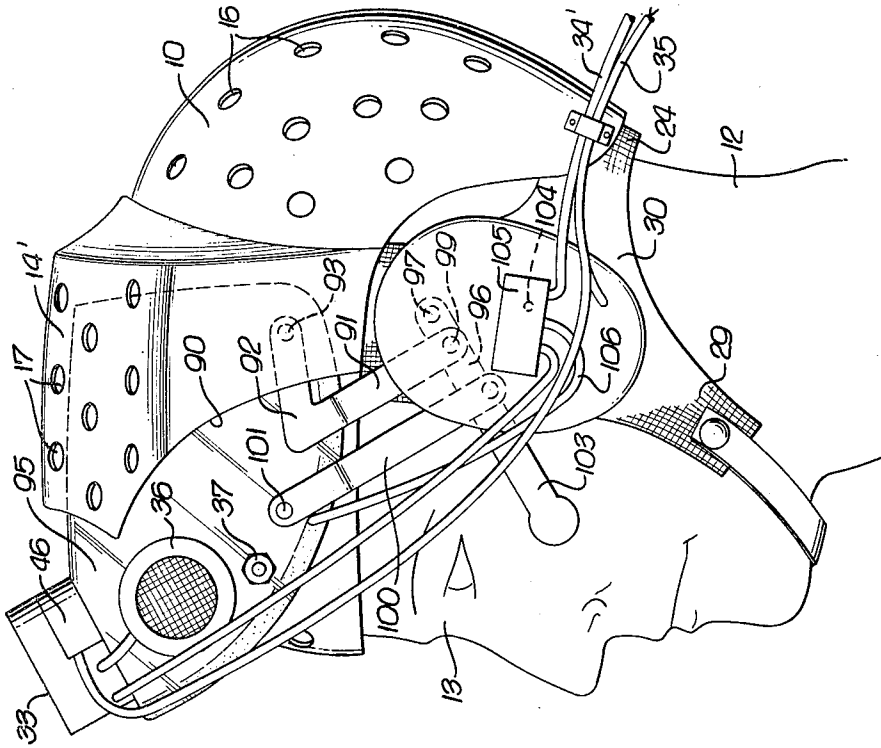


FIG. 10.

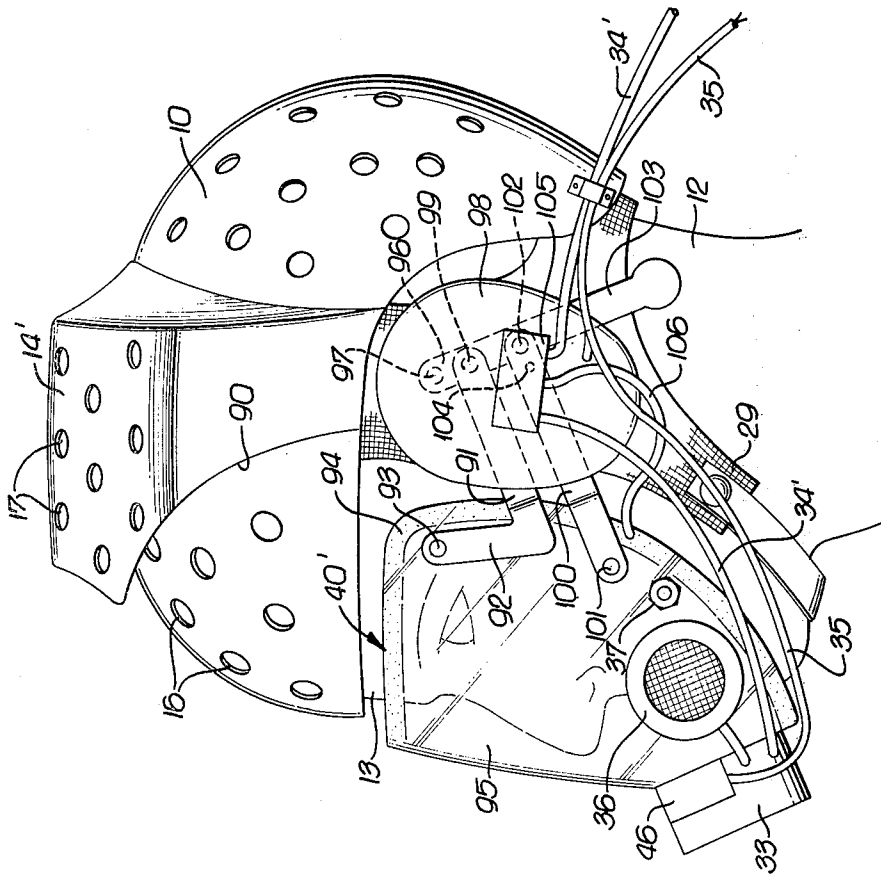


Fig. 13.

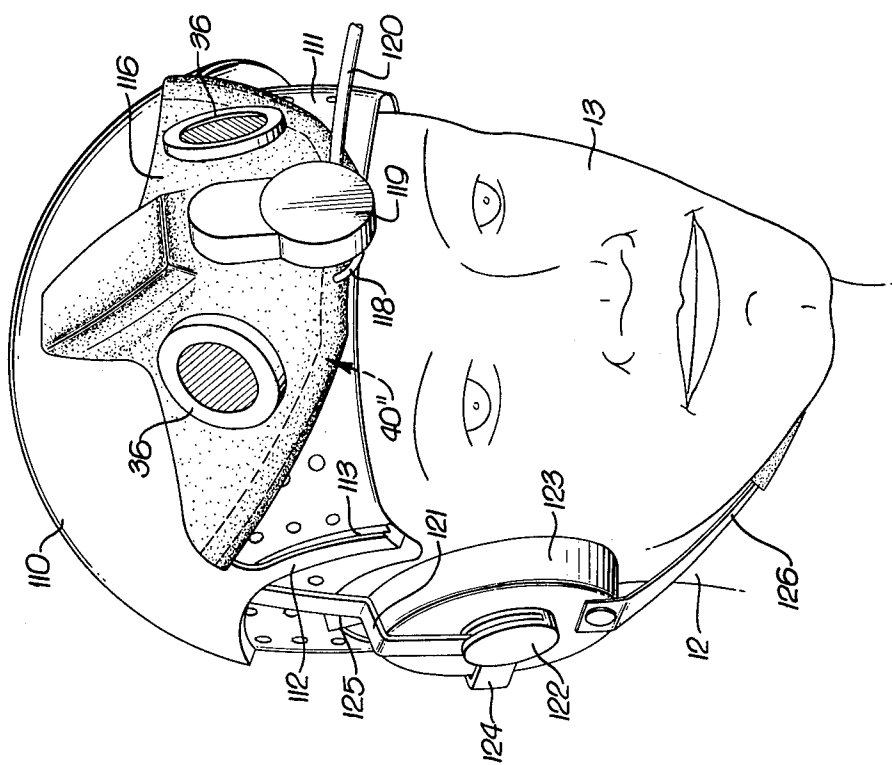
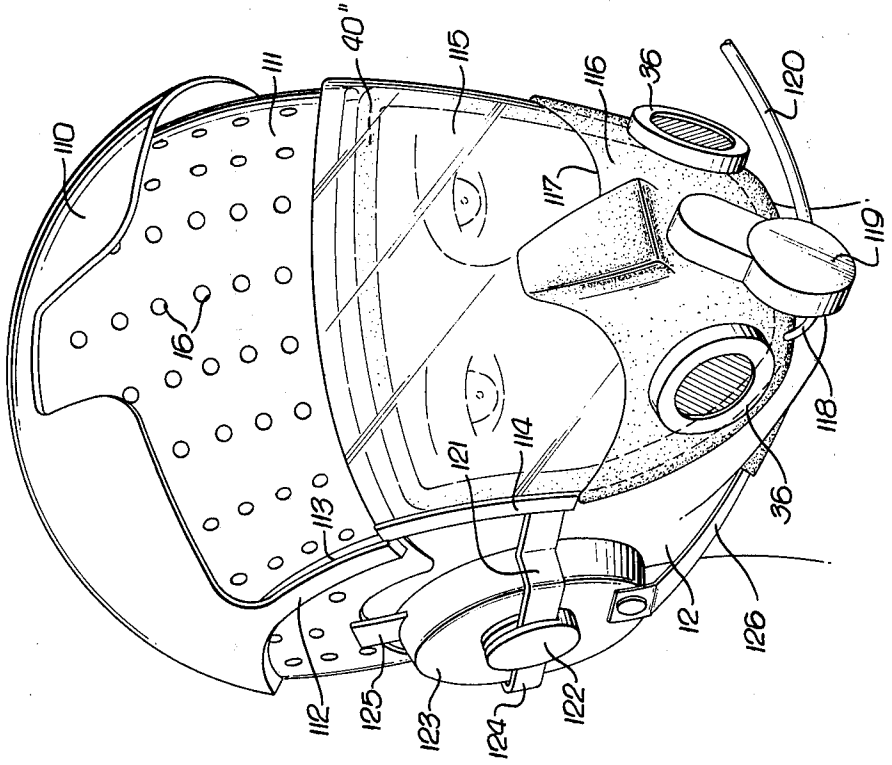


Fig. 12.



INTEGRATED HELMET AND MASK STRUCTURE

This is a division of application Ser. No. 255,838, filed May 22, 1972.

As aircraft capabilities continuously involve increased speeds, demands upon the men who fly them experience a change which, in part, adds greatly to the mental and physical stresses experienced. Physical discomforts are variable in nature and additive. Movement within the cockpit is confined and restricted. Added to this is the weight and restrictiveness of equipment worn by the pilot and crew and the heat generated within his personal flight safety equipment which, over long periods of flight duty, create extensive discomfort. Personal flight equipment can be said to comprise chiefly of a flight protection helmet equipped with oxygen mask, head-set or ear phones and a smoke-protective visor.

Respecting currently available personal equipment, a complaint and consequently a defect in addition to being too hot, too heavy, excessively cumbersome and too restrictive, is that the equipment has too many non-integrated components. Whatever remedy may be offered, however, the protection must still include protection against head injury as a result of buffeting or turbulence upon ejection, cabin or cockpit decompression, either explosive or otherwise, and eye protection from the smoke of cabin or cockpit fires as well as from spalling.

It is therefore among the objects of the invention to provide a new and improved helmet and mask integrated structure wherein the mask and communication equipment are so connected to the helmet itself as to present a more integrated combination which, at the same time, is cool and comfortable when worn.

Another object of the invention is to provide a new and improved helmet and mask integrated structure which is low in profile despite the need for a leverage or related mechanism to permit the mask assembly to be removed from the face.

Still another object of the invention is to provide a new and improved helmet and mask integrated structure provided with an inflatable seal between the mask assembly and the face of the wearer which can, when desired, be inflated automatically by oxygen pressure normally supplied to the mask and which provides for sufficient mask clearance of the face during donning.

Still further among the objects of the invention is to provide a mask assembly including an inflatable seal which is of such design and construction that it can be readily fitted to faces of different shape and size without need for changing the shape and size of the mask assembly and associated helmet shell.

With these and other objects in view, the invention consists in the construction, arrangement, and combination of the various parts of the device, whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a side elevational view of one form of the helmet and mask integrated structure shown in operative position on the head of a wearer.

FIG. 2 is a longitudinal sectional view of the structure of FIG. 1.

FIG. 3 is a fragmentary cross sectional view taken on the circular line 3 of FIG. 2 with the seal inflated.

FIG. 4 is a fragmentary sectional view similar to FIG. 3 but with the seal deflated.

FIG. 5 is a side elevational view similar to FIG. 1 but with the visor assembly lifted into inoperative position.

FIG. 6 is a fragmentary cross sectional view on the line 6—6 of FIG. 1.

FIG. 7 is a fragmentary longitudinal sectional view on the line 7—7 of FIG. 5.

FIG. 8 is a side elevational view of a second form of the invention shown in position on the head of a wearer.

FIG. 9 is a side elevational view of the same form of the device as in FIG. 8 but with the visor assembly lifted into inoperative position.

FIG. 10 is a side elevational view of another form of the device shown in operative position.

FIG. 11 is a side elevational view of the device of FIG. 10 but with the visor assembly lifted into inoperative position.

FIG. 12 is a front perspective view of a modified form of the invention as shown in operative position on the head of a wearer.

FIG. 13 is a front perspective view similar to FIG. 12 but with the visor assembly lifted into inoperative position.

In an embodiment of the invention chosen for the purpose of illustration, there is shown a hard helmet shell 10 equipped with a visor assembly indicated generally by the reference character 11 shown mounted on the head 12 of a wearer with the visor assembly in operative position applied to the wearer's face 13. A visor cover 14 is fixed in position at the crown of the helmet shell and provides a pocket 15. Extending through the helmet shell is a series of ventilating perforations 16, and perforations 17 in the visor cover assist the perforations 16 which open into the pocket 15. Perforations serve two functions; to provide for ventilation; to reduce weight, yet still provide protection. A shock or energy absorbing liner 18 extends around the entire inner surface of the helmet shell, the liner being of some appropriate foam cushion.

For supporting the helmet shell and perforce the helmet and mask integrated structure on the crown of the head 12, there is provided a sling 20 extending fore and aft and to which are applied a forehead cross-web 21, a crown cross web 22, a rear cross-web 23 and a nape cross-web 24 attached to the sling at the junctions shown. The sling and cross-webs are provided with elastomer pads 25, 26, 27 and 28 of appreciable depth sufficient to support the helmet shell in a position removed from contact with the head of the wearer providing a space from which heat from the wearer's head can pass outwardly through the perforations 16. A chin strap 29 serves to hold the sling and cross-webs in position, the chin strap and the cross-webs being all attached to a lateral webbing 30 surrounding the wearer's ears.

It will be understood that the lining of the helmet shell normally is spaced clear of the head of the wearer and that this spacing may vary to some extent depending upon the shape of the wearer's head and the height of the elastomer pads. The pads, moreover, are yieldable and the sling and cross-webs are likewise yieldable so that should there be an impact on the helmet shell sufficient to compress the pads at one location or another, the wearer's head will strike the liner. The liner is of a character capable of absorbing the impact and

the energy is dissipated, thereby protecting the head of the wearer.

It should be noted that the attachment of the ear cups to the helmet is flexible to allow lateral spreading to clear the ears for rapid donning. These flexible attachments facilitate folding ear cups into the inside of helmet shell for minimum storage volume.

The visor assembly 11 in this embodiment consists of two parts, namely, an eye area shell section 31 at a location surrounding the eyes of the wearer and an oral-nasal area shell section 32 which is the portion usually identified as a breathing mask and upon which is mounted a regulator 33 capable of accommodating appropriate valving (not shown) for an air or oxygen line 34 and a microphone (not shown) supplied by a microphone line 35.

In this embodiment there is also provided a compensated exhalation valve 36 and a relief valve 37 of substantially conventional construction.

For sealing the perimeter of the visor assembly to the face 13 of the wearer, use is made of a seal indicated generally by the reference character 40 which in the chosen embodiment is a hollow tube, as indicated in FIGS. 3 and 4. As shown in FIGS. 1 and 2, the tube extends around the lower and side edges of the oral-nasal area shell section 32, the side edges of the eye area shell section 31 and across the upper or forehead portion of the eye area shell section 31 at a location slightly removed from an upper edge 41. To the extent described, the seal is continuous and endless. In addition, there is a transverse section 42 of the seal which extends across the eye area shell section near the line 43 of junction between the eye area shell section and the oral-nasal area shell section. As shown in FIG. 2, the transverse section 42 is actually attached to a web 44 which lies inside of the eye area shell section 31. The transverse section, moreover, is in communication with the seal 40 at the point of junction.

For inflating the seal, use is made of an air line 45, shown in FIG. 1, which extends from an air switch 46 supplied in turn from the mask regulator 33.

In the air or oxygen line 34 is interposed an air valve 47 on which is an actuator button 48 which normally tends to move to a shutoff position. As shown in FIG. 1, the actuator button is moved to an "on" position by engagement therewith of a portion of a composite arm 50. A microphone switching arrangement also might be incorporated to switch "off" an external microphone (boom microphone) and switch on the microphone inside the mask.

As shown in FIG. 7 in company with FIG. 1, the composite arm consists of a plunger 51, an outer end of which is attached to a bracket 52 which, in turn, has a pivotal attachment 53 to the side of the oral-nasal area shell section 32.

A telescoping sleeve 54 forms a connection between the plunger 51 and a hollow cylinder 55. The cylinder is in turn attached by means of a screw 56 to a bracket 57, the bracket being part of an arm 58 which has a pivotal attachment 59 to the helmet shell 10.

As shown in FIG. 7, a spring 60 has one end 61 secured by a spring keeper 62 to the plunger 51 and has its other end 63 secured to a keeper 64 which is anchored to the bracket 57. The spring under tension is biased to draw the visor assembly in a direction from left to right as viewed in FIG. 1 so that the seal 40 is drawn into engagement with the face 13 of the wearer.

To assist in shifting the visor assembly 11 from the operative position shown in FIG. 1 to the withdrawn position of FIG. 5, use is made of a slot 65 in the visor cover 14 within which travels the shank 66 of a knob 67, the shank 66 being riveted at 68 to an adjacent edge 69 of the eye area shell section 31.

Although only one side of the visor assembly is shown in FIG. 1, it will be understood that the other side is identical except for being a right-hand side counterpart of the composite arm 50 and the slot 65 containing the shank 66. Connected as described, the visor assembly and helmet shell are an integrated structure in that, except for the upward and downward motion about the pivot joints, the visor assembly is firmly held in a fixed relationship with respect to the helmet shell.

When the visor assembly is to be moved from the operative position of FIG. 1 to the elevated position of FIG. 5, the mask regulator, protruding as it does, can be made use of in a sense as a handle when the visor assembly is lifted upwardly or counter clockwise as viewed in FIG. 5.

When this occurs, the arm 58 is moved from its position of engagement with the actuator button 48 and the air valve 47 then closes off the air line 34 so that no air flows either to the mask regulator 33 or to the seal 40 through the air line 45.

When this circumstance prevails, the seal 40 will collapse to the position shown in FIG. 4 by reason of the fact that the seal initially is given the collapsed form of FIG. 4 when molded. Collapsing as described, a sealing face 70 has a seal 40, which is the portion of the seal which actually engages the skin on the face 13 and draws away from the skin an appreciable distance, namely, about half the inflated height of the seal as shown in FIGS. 3 and 4. This provides adequate clearance so that when the mask assembly is lifted progressively from the position of FIG. 1 to the position of FIG. 5, there will be no resistance to its lifting. Additionally, when the mask assembly is elevated, the composite arm 50 then in an over-center position functions to pull the visor assembly toward the visor cover 14 until the eye area shell section is drawn into the pocket 15.

Conversely when the mask assembly is to be lowered into operating position, the mask regulator 33 and visor assembly is swung downwardly or counter-clockwise as viewed in FIG. 5, initially extending the spring 60 as it swings, until the positions of FIG. 1 are then accomplished. At this point the arm 58 engages the actuator button 48 thereby to admit automatically air from the air or oxygen line 34 to the mask regulator 33 and thence into the mask. At the same time, air under pressure passes through the air switch 46 and air line 45 into the seal 40 causing it to be inflated to the position of FIG. 3. In this position the sealing face 70 will be drawn gently into engagement with the face of the wearer thereby sealing all of that portion of the visor assembly which is defined by the perimeter of the seal as shown in FIGS. 1, 2 and 5.

In the form of invention of FIGS. 8 and 9, there is substituted for the composite arm 50 a compound lever assembly consisting of a lever arm 75 and lever arm 76. The lever arm 75 has a bent end section 77 extending at right angle to the lever arm, the end section 77 having a pivot connection 78 to the edge of the oral-nasal area shell section 32.

The lever arm 76 has a pivot connection 79 to an ear receptacle 80 which is an integral part of the helmet

shell 10. An extension 81 of the lever arm 76 protrudes below the ear receptacle and there is a pivot connection 82 between the lever arm 75 and the lever arm 76 at a location not far removed from the pivot connection 79. An actuator button 83 on an air valve 84 serves to automatically open the air valve when the extension 81 is in the position shown in FIG. 8 thereby to inflate the seal 40 while the visor assembly is in a position against the face 13 of the wearer.

Conversely when the visor assembly is lifted to the position of FIG. 9, the extension 81 moves out of engagement with the actuator button 83 thereby permitting the air valve to close and cut off the air supply whereupon the seal 40 collapses in the manner previously described. In this form of invention, an air line 85 extends from the air valve 84 to a side portion of the seal 40 as shown in FIG. 8.

When the visor assembly is in the operating position of FIG. 8 and the wearer wishes to press it more snugly against his face, the extension 81 can be employed to help tighten the seal by pushing rearwardly against the extension. When it has been pushed far enough, a locking button 86, of substantially conventional construction, can be turned to tighten engagement of a corner tab 87 of the eye area shell section 31 to the visor cover 14 which is immediately adjacent the end of the slot 65.

When the visor assembly is to be lifted clear of the face the locking button 86 is loosened. The visor assembly can then be lifted to the position of FIG. 9. Meanwhile the locking button and its attached shank 88 move to the opposite end of the slot 65 and there again can be tightened so as to be capable of holding the visor assembly in the elevated position until it is to be released.

Additionally, this engagement of the extension 81 from the actuator button 83 causes the air valve 84 to shut off the supply of air and the seal 40 thereupon will collapse.

In the form of invention of FIGS. 10 and 11, the visor cover 14' is cut away at 90 and the slot 65 dispensed with. A lever system of three lever arms is made use of for holding and guiding the visor assembly relative to the helmet shell. The lever system consists of a lever arm 91 having a bent section 92 at one end which by means of a pivot connection 93 is attached to a corner 94 of a transparent visor 95. A lever arm 96 has a pivot connection 97 to an ear receptacle 98 which is an integral part of the helmet shell 10. A pivot connection 99 interconnects the lever arm 91 with the lever arm 96.

Another lever arm 100 has a pivot connection 101 at one end to the visor 95 about midway between the top and the bottom. At the other end of the lever arm is a pivot connection 102 which connects the lever arm 100 to the lever arm 96 at a location farther away from the pivot connection 97 than the pivot connection 99 previously described. An extension 103 of the lever arm 96 protrudes to a position below the ear receptacle 98.

An actuator button 104 on an air valve 105 serves a function similar to the previously described actuator button 83 in that in the lowered or operative position of FIG. 10, the actuator button 104 is tripped by the lever arm 100 and causes the air valve to open thereby to inflate a seal 40'. When the visor assembly is lifted to the position of FIG. 11, the lever arm 100 is moved free of the actuator button 104 causing it to shut off the supply of air whereupon to collapse the seal 40'.

In this form of the invention the visor 95 is substantially a single piece transparent visor which covers the surface of the wearer's face 13 both above and around the eyes and around and below the nose and mouth. In this way a single perimetrical seal 40' extending around the edge of the visor 95 forms a seal between the visor and the face of the wearer. An air line 106 communicates between the air valve 105 and the seal 40' so that air from an air or oxygen line 34' can be made to supply both air pressure for the seal 40' and air to the mask regulator 33 which communicates with the area beneath the visor 95 in a substantially conventional manner.

A somewhat different form of helmet and mask integrated structure is shown in FIGS. 12 and 13. There a visor cover 110 mounted on a helmet shell 111 is provided with a pair of forwardly extending extensions 112 in each of which is a track 113. A shoe 114 on either side of an eye area shell section 115 is curved to match the curvature of the track 113 and is adapted to slide with respect to the track as the eye area shell section is moved upwardly from the position in FIG. 12 to the position of FIG. 13. A mask section 116 adapted to extend around the nose and mouth of the wearer is integrally attached to the eye area shell section along the line 117.

A seal 40'' of the same general character as the seals 40 and 40' heretofore described, extends around the perimeter of the eye area shell section 115 and the mask section 116, the seal being supplied with air through an air line 118 fed from a mask regulator 119. The mask regulator is in turn supplied by an air line 120.

To additionally hold and guide the eye area shell section and hence what constitutes a mask assembly, there is provided a pair of lift arms 121, one on each side, one only being shown in FIGS. 12 and 13. The lift arm 121 is pivoted beneath a pivot connection 122, the pivot connection being mounted upon and anchored to an ear receptacle 123.

The ear receptacle 123 is made to act substantially integrally with the helmet shell 110 by employment of a rear strap 124 and an upper strap 125. The straps may be either a synthetic plastic resin material or a spring metal material which by flexing in the direction of the flat areas permits the ear receptacles to be easily moved upwardly away from the head and ears of the wearer when the helmet is to be donned and which, upon release, will cause the ear receptacles to be sprung inwardly into contact with the area around the ears of the wearer by virtue of the return acting spring effect of the straps 124 and 125. A chin strap 126 helps hold the assembly in place.

Here, again, except for the movement up and down of the visor and mask combination relative to the helmet shell, the helmet shell and the visor and mask combination have only very limited movement in any other direction thereby making them a substantially integrated structure, which fits under the visor cover 110 when elevated to the position of FIG. 13, and which snugly seals around the face of the wearer in the position of FIG. 12.

While the invention has herein been shown and described in what is conceived to be a practical and effective embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein

but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

Having described the invention, what is claimed as new in support of Letters Patent is:

1. An integrated helmet and mask structure for the head and face of a wearer, said structure comprising a hard helmet shell, a visor assembly including a mask shell and having an articulated attachment on each side to the helmet shell and valve means on the mask shell including a supply of breathing gas for directing such gas to the mask structure, said mask shell having an inner surface adapted to face the face of the wearer, means for moving the mask shell toward and away from a position adjacent the face of a wearer, a hollow sealing tube extending around the edge of the mask shell on the side thereof facing the face, said sealing tube having a fixed sealed attachment to said mask shell, a hose in communication between the valve means and the sealing tube for introducing breathing gas from the supply for the valve means into said tube, said tube having a normally collapsed condition in a direction perpendicular with respect to the inner surface of the mask shell at all locations of attachment, said sealing tube being withdrawn from the adjacent face of the wearer when not subject to gas under pressure and an inflated condition when subject to gas under pressure, the tube when in inflated condition under pressure of gas from said gas supply being adapted to have a sealing relationship with the face of the wearer.

2. An integrated helmet and mask structure as in claim 1 wherein said valve means is mounted on the helmet shell and includes a mask supply line and a seal supply line, and a valve actuator in operative relationship with the seal supply line.

3. An integrated helmet and mask structure as in

claim 2 wherein said valve actuator has an open condition when out of engagement with a portion of said articulated attachment wherein there is an open connection for gas under mask pressure to said sealing tube, said valve actuator having a closed condition when said articulated attachment is at a position of engagement with said valve actuator wherein there is a closed connection shutting off gas under mask pressure to the sealing tube whereby the tube is deflated.

4. An integrated helmet and mask structure as in claim 1 wherein the sealing tube is an endless tube extending around the perimeter of said mask shell.

5. An integrated helmet and mask structure as in claim 4 wherein there is a transverse section of sealing tube extending across the interior of said mask shell at a location intermediate an eye surrounding area and an oral-nasal surrounding area, and wherein said transverse section is connected to the sealing tube and subject to respectively inflated and collapsed conditions when the remainder of the sealing tube is subject to respectively inflated and collapsed conditions.

6. An integrated helmet and mask structure as in claim 5 wherein there is a flexible web between said transverse section of the sealing tube and said oral-nasal surrounding area of the visor, said web comprising a flexible attachment for the sealing tube to the visor.

7. An integrated helmet and mask structure as in claim 1 wherein said sealing tube has a long dimension substantially perpendicular to said inner surface and a substantially short dimension at right angles thereto, said sealing tube having a normally collapsed condition in the direction of said long dimension to which it returns when not subject to internal air pressure.

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